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Total Number of Pages in This Submission

Application Number	10/798,932
Filing Date	March 11, 2004
First Named Inventor	Scott Arthur William Muirhead
Art Unit	3637
Examiner Name	Jose V. Chen
Attorney Docket Number	9085-A

ENCLOSURES *(Check all that apply)*

- ☐ Fee Transmittal Form
 - ☐ Fee Attached
- ☐ Amendment/Reply
 - ☐ After Final
 - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Reply to Missing Parts/ Incomplete Application
 - ☐ Reply to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
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NEXTREME
9085

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE



Examiner:	Jose V. Chen
Group Art Unit:	3637
Application No.:	10/798,932
Filed:	March 11, 2004
Applicant:	Scott Arthur William Muirhead
Title:	THERMOFORMED PLATFORM

AMENDED APPEAL BRIEF PURSUANT TO 37 C.F.R. § 41.37

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner:	Jose V. Chen
Group Art Unit:	3637
Application No.:	10/798,932
Filed:	March 11, 2004
Applicant:	Scott Arthur William Muirhead
Title:	THERMOFORMED PLATFORM



AMENDED APPEAL BRIEF PURSUANT TO 37 C.F.R. § 41.37

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Alexandria, VA 22313-1450

Dear Sir:

Pursuant to the Notification of Non-Compliant Appeal Brief mailed March 11, 2004, Appellant Scott William Arthur Muirhead respectfully submits this amended appeal brief, which is due by September 15, 2008.[1]

[1] The recent amendment to appellate brief format requirements under 37 C.F.R. § 41.37 do not apply because the effective date of these requirements is December 10, 2008, which is after the filing date of the instant appeal. See 73 F.R. 32938.

I. REAL PARTY IN INTEREST

The real party in interest is appellant Nextreme, L.L.C., whose business address is 2282 University Drive, Suite 1, Lemont Furnace, Pennsylvania 15456.

II. RELATED APPEALS AND INTERFERENCES

There are no other prior or pending appeals, interferences, or judicial proceedings, which may be related to, directly affect or be directly affected by or have bearing on the Board's decision.

Applicant has taken the position that claim 19 of the instant application interferes with claim 14 of U.S. Patent No. 6,758,148 by Torrey et al. However, the examiner has not declared an interference between those claims due to *inter alia* the fact that claim 19 of the instant application has not been allowed.

The interference issue is now moot because Torrey et al. was expressly abandoned on June 17, 2008.

III. STATUS OF CLAIMS

Claims 1-27 are pending in the application. Claims 1-10 have been withdrawn pursuant to a restriction requirement. Claims 11-18 have been allowed.

The present appeal is directed to claims 19-27, which were finally rejected in an Office action dated June 3, 2008.

IV. STATUS OF AMENDMENTS

No amendment to the claims was filed subsequent to the most recent final rejection.

V. SUMMARY OF CLAIMED SUBJECT MATTER

The present invention, as described in independent claim 19, is directed to a fire resistant pallet. The pallet includes a pallet assembly. (Pages 23-25, Paragraph Nos. 58-63, Fig. 3-5). The pallet also includes a fire resistant layer formed upon an exterior of said pallet assembly. (Pages 11-12, Paragraph No. 25).[2]

The present invention, as described in dependent claim 20 separately argued pursuant to 37 C.F.R. 41.37(c)(1)(vii), is directed to a pallet. The pallet

[2] Claim 22 was rejected under 35 U.S.C. § 103 over the same reference. See Office Action at 4. Accordingly, claim 22 stands and falls with claim 19.

includes the pallet assembly and the fire resistant layer of claim 19. The pallet assembly is made of a polyolefin resin. (Pages 32-33, Paragraph No. 81). The fire resistant layer is made of an intumescent polyolefin material. (Pages 31-32, Paragraph No. 80). The pallet assembly and fire resistant layer are co-extruded. *Id.*

The present invention, as described in dependent claim 23 separately argued pursuant to 37 C.F.R. 41.37(c)(1)(vii), is directed to a pallet. The pallet includes the pallet assembly and the fire resistant layer of claim 19. The fire resistant layer includes an intumescent polyolefin composition resistant to fire. (Pages 31-32, Paragraph No. 80). The intumescent polyolefin composition is co-extruded with at least a portion of the pallet assembly. *Id.*

The present invention, as described in independent claim 24, is directed to a fire resistant pallet. The pallet includes a first layer of moldable intumescent material. (Pages 31-32, Paragraph No. 80). The pallet also includes a second layer of moldable polyolefin material. (Pages 32-33, Paragraph No. 81). The first and second layers are co-extruded together prior to

being molded into the fire resistant pallet. (Pages 31-32, Paragraph No. 80).

The present invention, as described in independent claim 26, is directed to a fire resistant pallet. The pallet includes a moldable mixture of intumescent materials comprising a polyethylene resin. (Pages 31-32, Paragraph No. 80).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1) The examiner's evaluation and characterization of the content of the Coleman Declaration and the Muirhead Declaration;

2) The rejection of claim 19 under 35 U.S.C. § 102(b) as being anticipated by Apps et al. (U.S. Patent No. 6,006,677);

3) The rejection of claim 19 under 35 U.S.C. § 102(b) as being anticipated by Gronnevik (U.S. Patent No. 5,845,588); and

4) The rejection of claim 20, 21, and 23-27 under 35 U.S.C. § 103(a) as being unpatentable over Gronnevik in view of Ford et al. (U.S. Patent No. 6,228,914).

VII. ARGUMENT

This brief addresses five issues. The first issue relates to the examiner's improper evaluation and characterization of the evidence set forth in the Coleman Declaration and the Muirhead Declaration. The second and third issues relate to the examiner's anticipation rejections of claim 19. The fourth issue relates to the examiner's obviousness rejection of claims 20, 21, and 23-27. The fifth issue relates to the examiner's failure to apply a uniform standard of obviousness in examining applications covering similar subject matter. Each issue is addressed below.

A. The Examiner's Evaluation of the Coleman Declaration and the Muirhead Declaration Was Improper Because the Evidence Set Forth in the Declarations Was Mischaracterized.

The examiner mischaracterized the evidence set forth in the Coleman Declaration and the Muirhead Declaration as being limited to evidence of "secondary considerations." The examiner also erroneously asserted that "there is no factual evidence of the stated opinions, such as testing results."

As an initial matter, it appears that the examiner has taken the position that the evidence set forth in the declarations must be evidence of "secondary

considerations" because the declarations were submitted under 37 C.F.R. § 1.132. However, evidence submitted under 37 C.F.R. § 1.132 is not limited to evidence of secondary considerations, as follows:

> When any claim of an application or a patent under reexamination is rejected or objected to, any evidence submitted to traverse the rejection or objection on a basis not otherwise provided for must be by way of an oath or declaration under this section.

37 C.F.R. § 1.132. Accordingly, the mere fact that a declaration is filed under 37 C.F.R. § 1.132 does not expressly or implicitly indicate that the evidence is directed solely to evidence of secondary considerations.

On the merits, the next two subsections (i.e. Parts A.1. and A.2.) illustrate why the evidence set forth in the Coleman Declaration and the Muirhead Declaration is not limited to evidence of secondary considerations. The evidence set forth in the two declarations includes evidence relating to the examiner's erroneous assertions regarding inherency. The evidence set forth in the two declarations also includes evidence addressing the examiner's *prima facie* case of obviousness, as opposed to evidence relating to secondary considerations.

The third subsection (i.e. Part A.3.) addresses the examiner's assertion that the declarations do not contain "factual" evidence or test results. Both declarations include factual evidence. The Muirhead Declaration also includes test results, which directly contradicts the Examiner's assertion. Accordingly, the following three subsections demonstrate that the examiner's characterization of the evidence in the declarations was fundamentally flawed.

1. Reconsideration of the Anticipation Rejection of Claim 19 is Warranted Because Applicant is Entitled to a Fair Review of the Evidence That Addressed the Inherency Doctrine.

Reconsideration of the anticipation rejection of claim 19 is warranted because Applicant is entitled to a fair review of the evidence that addressed the inherency doctrine. By mischaracterizing the evidence in the declarations, the examiner failed to properly consider the evidence of record that illustrates why claim 19 is not anticipated by the two references of record.

Applicant had the right to address the examiner's assertions regarding inherency. Once an examiner makes an inherency argument, an applicant has the right "to

prove that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product." MPEP § 2112. The examiner must provide a rationale or evidence tending to show inherency. *Id.* The examiner never followed these procedures.

Both declarations include ample evidence that refutes the examiner's misplaced application of the inherency doctrine. See Coleman Dec. ¶¶ 12-22; Muirhead Dec. ¶¶ 5-11. Accordingly, the Board must remand the instant application back to the examiner for reconsideration of the rejection of claim 19 to give proper consideration of the evidence of record. Alternatively, the Board should reverse the rejection for the reasons set forth in Parts B-C set forth below.

2. Reconsideration of Claims 20, 21, and 23-27 is Warranted Because Applicant is Entitled to a Fair Review of the Evidence That Addressed the Purported *Prima Facie* Case of Obviousness.

Reconsideration of claims 20, 21, and 23-27 is warranted because Applicant is entitled to a fair review of the evidence that addressed the purported *prima facie* case of obviousness. Notwithstanding the examiner's erroneous assertions to the contrary, the

Coleman Declaration actually includes evidence that addresses the *prima facie* case of obviousness, as opposed to secondary considerations of nonobviousness. Specifically, the Coleman Declaration includes two paragraphs that illustrate why the examiner's asserted combination of the Gronnevik reference and the Ford et al. reference would be inoperable. See Coleman Dec. ¶¶ 23-24.

Similarly, the Muirhead Declaration includes evidence that demonstrates why the same combination is inoperable. See Muirhead Dec. ¶¶ 12-13. Applicant is entitled to a fair review of this evidence.

The MPEP expressly states that "the prior art reference (or references when combined) must teach or suggest all the claim limitations" to establish a *prima facie* case of obviousness. MPEP § 2142. The above-identified paragraphs from the Coleman Declaration and the Muirhead Declaration demonstrate that the two references cited by the examiner cannot be combined to produce an operable apparatus. Accordingly, the examiner's rejection of claims 20, 21, and 23-27 for obviousness must be remanded back to the examiner for further consideration. Alternatively, the examiner's

rejection should be reversed for the reasons set forth in Part D. below.

3. Reconsideration of Claims 20, 21, and 23-27 is Also Warranted Because the Evidence Set Forth in the Declarations Is Not Limited to Opinion Evidence.

Reconsideration of claims 20, 21, and 23-27 is also warranted because the evidence set forth in the declarations is not limited to opinion evidence. The evidence set forth in the Coleman Declaration includes factual evidence. Examples of factual evidence set forth in the Coleman Declaration include:

- "The [McGrath Reference] includes no disclosure or suggestion that all plastics provide fire resistance." [Coleman Dec. ¶ 13].

- "Indeed, the McGrath Reference states that the two engineering resins 'are considered candidates for fire safe thermoplastic materials.'" [Coleman Dec. ¶ 14].

- "The term 'fire safe' is used in the industry to denote a class of polymers that can meet the more demanding application areas of plastics. This includes commercial aircraft where approximately two or three minutes are allowed to evacuate a distressed airplane before the fire hazard from all sources is considered too great to survive. The plastic that is currently used for aircraft interiors is expensive (over $ 20 per pound) and 'fire safe' cost effective replacements have been an important target for those doing plastics research for many years. Professor McGrath has been working in this area for many years as have others. So far no 'fire safe' candidates

have replaced the existing plastic, so the search continues for a truly 'fire safe' plastic." [Coleman Dec. ¶ 15].

- "The Vinyl Institute Reference does not state that plastics, in general, inherently provide fire resistance." [Coleman Dec. ¶ 16].

- "The Gronnevik patent discloses a multi-layer structure, but does not disclose a multi-layer structure in which a fire resistant layer covers a polyolefin base material." [Coleman Dec. ¶ 21].

Clearly, the evidence set forth in the Coleman Declaration is not limited to opinion evidence.

Similarly, the evidence in the Muirhead Declaration includes factual evidence. An example of the factual evidence set forth in the Muirhead Declaration includes:

- "U.S. Patent No. 6,006,677 ('the Apps patent') does not include the phrase 'a fire resistant layer formed upon an exterior of the pallet assembly.' In fact, the Apps Patent does not even include the words 'fire', 'flame' or any equivalent." [Muirhead Dec. ¶ 5].

Accordingly, the evidence set forth in the Muirhead Declaration is not limited to opinion evidence.

In addition, an examination of the Muirhead Declaration further demonstrates that the examiner's assertion that "there is no factual evidence of the stated opinions, such as testing results" is

demonstrably false. Paragraph 19 of the Muirhead Declaration describes test results that were obtained from test samples. The test results are shown in the figure that was attached to the declarations. See Muirhead Dec. ¶ 1 (citing Figure 1).

Moreover, the examiner's assertions regarding "factual evidence" are irrelevant because the MPEP expressly states that "[a]lthough factual evidence is preferable to opinion testimony, such testimony is entitled to consideration and some weight so long as the opinion is not on the ultimate legal conclusion at issue." See MPEP § 716.01(c). Accordingly, the examiner cannot give the declarations short shrift merely by asserting that they are not based on "factual evidence." For these reasons, the application should be remanded back to the examiner for further consideration of the evidence set forth in the declarations. Alternatively, the examiner's obviousness rejection should be reversed for the reasons set forth in Part D.

B. Reversal of the Rejection of Claim 19 as Being Anticipated by Apps et al. Is Warranted Because Apps et al. Does Not Disclose or Suggest a Fire Resistant Layer Formed on the Outer Surface of a Pallet.

Reversal of the rejection of claim 19 as being anticipated by Apps et al. is warranted because Apps et al. does not disclose or suggest a fire resistant layer that is formed on the outer surface of a pallet. A rejection for anticipation under 35 U.S.C. § 102 requires that a single prior art reference discloses, "either explicitly or inherently", each limitation of a claim. *Perricone v. Medicis Pharmaceutical Corp.*, 432 F.3d 1368, 1375 (Fed. Cir. 2005)(additional citations omitted). The evidence of record demonstrates that Apps et al. does not explicitly or inherently disclose all of the limitations of claim 19.

It is undisputed that Apps et al. does not explicitly disclose a fire resistant layer. Rather, Apps et al. discloses a plastic pallet having an anti-slip "layer" that is provided by scuffing the outer surface. The anti-slip "layer" is made from the same material as the rest of the bulk material. Accordingly, the rejection turns on whether Apps et al. inherently discloses a fire resistant layer.

The purported basis/reasoning for the inherency rejection is the examiner's assertion that all thermoplastic materials "provide a fire resistant layer." Office Action at 2. The Board of Patent Appeals and Interferences set forth a standard for evaluating an examiner's assertion of the inherency doctrine, as follows:

> [i]n relying upon the theory of inherency, the Examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art.

Ex parte Levy, 17 U.S.P.Q.2d 1461, 1464 (Bd. Pat. App. & Inter. 1990). The evidence of record demonstrates that the examiner has not met this standard.

The evidence of record establishes that the purported technical reasoning for the examiner's assertion of the inherency doctrine is flawed. Specifically, the Coleman Declaration demonstrates that the two references cited by the examiner in support of the assertion do not state what the examiner asserts they state. See Coleman Dec. ¶¶ 12-19.[3]

[3] The Muirhead Declaration also addresses the examiner's rejection of claim 19. See Muirhead Dec. ¶¶ 7-11.

Indeed, the Coleman Declaration demonstrates that at least one of the references, the McGrath reference, directly contradicts the examiner's position. Coleman Dec. ¶ 14. This contradiction establishes that thermoplastic materials are not necessarily fire resistant materials.

In addition, the Coleman Declaration indicates that the examiner is not using the proper terminology in describing the content of the references. The Coleman Declaration indicates that the McGrath reference refers to "fire safe" polymers, not "fire resistant" plastics, and that the term "fire safe" has a very specific definition to a person of ordinary skill in the art. See Coleman Dec. ¶ 15.

The Coleman Declaration also indicates that the Vinyl Institute reference is of limited value because it relies upon ASTM standards, which include the following disclaimer:

> "This standard should be used to measure and describe the fire response of materials, products, or assemblies to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire-hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire-hazard assessment or a fire risk assessment which takes into account all of

> the factors which are pertinent to an assessment of the fire hazard or fire-risk of a particular end use."

Coleman Dec. ¶ 18 (citing Annual Book of ASTM Standards 2006, Vol. 8.01, D 2843 p. 714 ¶ 1.4). Accordingly, the evidence of record demonstrates that the inherency doctrine cannot be applied in the instant case because the existence of a "fire resistant layer" does not necessarily flow from the teachings of the cited prior art.

Moreover, common sense dictates that all plastics are not inherently fire resistant. On June 19, 2008, two patent applications were published that expressly stated:

> [f]urthermore, the problem arises in the case of plastic pallets that plastic is flammable such that, in the event of fire, toxic gases can develop.

U.S. Patent Publication No. 2008/0141912 A1 ¶ 3; U.S. Patent Publication No. 2008/0143514 A1 ¶ 3. Accordingly, the examiner's assertion that plastics are inherently fire resistant is baseless.

In addition, common sense dictates that the anti-slip "layer" in Apps et al. should have the same flammability properties as the bulk material because the anti-slip "layer" is made from the same material.

Accordingly, Apps et al. does not expressly or inherently disclose a fire resistant layer, and the anticipation rejection of claim 19 must be reversed for the reasons set forth above.

C. Reversal of the Rejection of Claim 19 as being Anticipated by Gronnevik Is Warranted Because Gronnevik Does Not Disclose or Suggest a Fire Resistant Layer Formed on the Outer Surface of a Pallet.

Reversal of the rejection of claim 19 as being anticipated by Gronnevik is warranted because Gronnevik does not disclose or suggest a fire resistant layer formed on the outer surface of a pallet. Gronnevik discloses a multi-layer structure in which a polyolefin material is coated with an anti-slip layer of EVA or EBA. See column 5, lines 54-55.

It is undisputed that Gronnevik does not explicitly disclose a fire resistant layer. However, the examiner, again, relied upon the same flawed reasoning discussed in Part B above to assert that thermoplastic materials inherently "provide a fire resistant layer." Office action at 2. Accordingly, the analysis set forth in Part B applies to the Gronnevik rejection, as well.

The Coleman Declaration and the Muirhead Declaration include ample evidence to refute the examiner's flawed

assertions regarding the purported fire resistance of thermoplastic materials. See Coleman Dec. ¶¶ 12-19; Muirhead Dec. ¶¶ 7-11. Accordingly, the rejection of claim 19 as being anticipated by Gronnevik should be reversed for the same reasons as set forth in Part B above.

The Coleman Declaration also indicates that the problems that are addressed in Gronnevik (i.e. plastic pallets that have an outer surface with a low coefficient of friction) are unrelated to the inherent lack of fire resistance of plastic materials. See Coleman Dec. ¶ 22. Accordingly, the rejection of claim 19 as being anticipated by Gronnevik must be reversed for the reasons set forth above.

D. Reversal of the Rejection of Claims 20, 21, and 23-27 as Being Rendered Obvious by Gronnevik and Ford et al. Is Warranted Because the Combined References Do Not Produce an Operable Combination.

Reversal of the rejection of claims 20, 21, and 23-27 as being rendered obvious by Gronnevik and Ford et al. is warranted because the combined references do not produce an operable combination. The Federal Circuit has held that "a proposed modification [is] inappropriate for an obviousness inquiry when

modification render[s] the prior art reference inoperable for its intended purpose." *In re Fritch*, 972 F.2d 1260, 1265-66 n. 12 (Fed. Cir. 1992); (*citing In re Gordon*, 733 F.2d 900, 902, 221 USPQ 1125, 1127 (Fed. Cir. 1984)). Accordingly, Ford et al. and Gronnevik cannot be combined to render the above-identified claims obvious.

Ford et al. discloses an aqueous intumescent composition that is applied by conventional coating methods, such as spraying, dipping, drawing, and brushing to a structure after its formation. See Ford et al., Col. 12, lines 1-8. Ford et al. does not teach or suggest that the disclosed intumescent composition can be co-extruded with a polyolefin base material.

Indeed, the Coleman Declaration indicates that Gronnevik cannot be combined with Ford et al. because Ford et al.:

> discloses an aqueous intumescent composition, which is not suitable for melt processing in a co-extrusion process. As a result, a person of ordinary skill in the art is unlikely to combine the Gronnevik patent with the Ford patent to produce a polyolefin patent having an intumescent layer through a co-extrusion process. The Ford coating is not formulated for compatibility with polymer melts; it is a coating that is formulated to bond to rough surface materials as described in the examples. The coating is applied to an existing surface.

> This Ford coating is a thermoset polymer that cannot be melt processed once it is heated to the curing temperature. Thus, it is totally unsuitable for extrusion or co-extrusion.

Coleman Dec. ¶ 24. Accordingly, any attempt to combine the teaching of Gronnevik with Ford et al. would result in an inoperable combination because the coating disclosed in Ford et al. cannot be melt processed.

Moreover, the use of an EVA layer in Gronnevik is a teaching away from the claimed inventions. It is well known that EVA is a "highly flammable material" that cannot be used in "structures where low flammability is required." U.S. Patent No. 7,037,576 at Col. 1, lines 62-67. Accordingly, a person of ordinary skill in the art is unlikely to combine Gronnevik and Ford et al. to produce the claimed invention. Consequently, the rejection of claims 20, 21, and 23-27 under 35 U.S.C. § 103(a) must be reversed.

E. Reversal of the Examiner's Rejections of Claims 19-27 Is Warranted Because the Examiner Has Been Applying an Arbitrary and Capricious Standard of Patentability to those Claims.

Reversal of the examiner's rejections of claims 19-27 is warranted because the examiner has been applying an arbitrary and capricious standard of patentability to those claims. As noted above, claim 19 of the instant

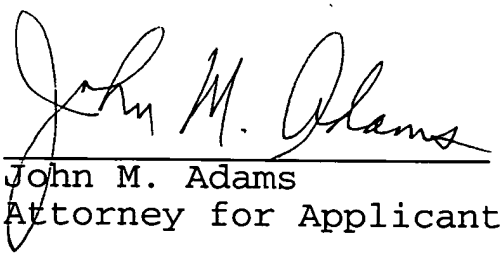
application interferes with claim 14 of U.S. Patent No. 6,758,148 by Torrey et al Claim 14 of Torrey et al. was determined to be patentable by the same examiner. Accordingly, it is axiomatic that claim 19 of the instant application should have been allowed.

Similarly, claims 20-27 are narrower than claim 14 of Torrey et al. Accordingly, it is axiomatic that if claim 14 of Torrey et al. was allowed, claims 20-27 should have been allowed, as well.

F. Conclusion

For the reasons set forth above, the rejections of claims 19-27 must be remanded for reconsideration or reversed.

Respectfully submitted,



John M. Adams
Attorney for Applicant

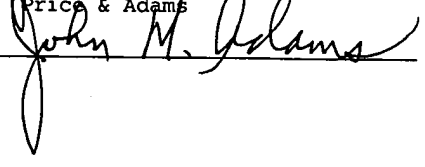
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August 21, 2008

APPENDIX 1 - CLAIMS APPENDIX

Claim 1 (withdrawn): A method for improving the bond strength between at least two heat deformed thermoplastic sheets forming a unitary structure, the method comprising:

extruding a continuous web of thermoplastic having a top surface and a bottom surface;

conveying the continuous web of thermoplastic through a down-stream work station scuffing the top surface, wherein the top surface is characterized having increased surface area relative the bottom surface;

shearing the continuous web of thermoplastic providing a plurality of sheets having scuffed top surfaces;

thermoforming simultaneously at least a first sheet over a first mold and a second sheet over a second mold upon a machine frame; and

compressing a heated first sheet against a heated second sheet between the first mold and the second mold upon the machine frame to bond the scuffed top surface of the first sheet to the smooth surface of the second sheet.

Claim 2 (withdrawn): The method of claim 1 wherein three scuffed sheets are thermoformed simultaneously and compressed sequentially upon a machine frame to provide a unitary triple sheet structure.

Claim 3 (withdrawn): The method of claim 1 wherein the continuous web of thermoplastic is conveyed through at least one down-stream workstation whereby the top and bottom smooth surfaces of said continuous web are scuffed increasing the surface areas thereof.

Claim 4 (withdrawn): An article of the method of claim 3 characterized in that the article is a thermoformed plastic pallet.

Claim 5 (withdrawn): An article made in accordance with the procedure comprising:

(a) extruding a continuous web of thermoplastic having a top surface and a bottom surface;

(b) conveying the continuous web of thermoplastic through a scuffing work station where after the top surface is characterized having increased surface area relative the bottom surface;

(c) shearing the continuous web of thermoplastic providing a plurality of sheets having scuffed top surfaces;

(d) heating a first sheet;

(e) forming the first sheet with a first mold;

(f) heating a second sheet;

(g) forming the second sheet with a second mold;

(h) aligning the first mold with the second mold so a scuffed top surface of the first sheet faces a bottom surface of `the second sheet:

(i) moving the first mold toward the second mold; and

(j) joining together sections of the scuffed top surface of the first sheet with sections of the bottom surface of the second sheet to form a twin sheet subassembly.

Claim 6 (withdrawn): An article made in accordance with claim 5 wherein the thermoplastic is composed of a polyolefin resin.

Claim 7 (withdrawn): An article made in accordance with claim 5 wherein after step (j) the method further comprises:

(k) heating a third sheet;

(l) forming the third sheet with a third mold;

(m) aligning the third mold with the twin sheet assembly;

(n) moving the twin sheet assembly toward the third mold; and,

(o) joining together sections of a scuffed top surface of the twin sheet assembly with sections of the bottom surface of the third sheet to form a triple sheet article.

Claim 8 (withdrawn): An article made in accordance with claim 5 wherein at least one exposed surface of the article is scuffed providing a high coefficient of friction skid resistant surface.

Claim 9 (withdrawn): An article made in accordance with claim 5 wherein after the step (e) a rigid member is positioned over the first sheet prior to the step (j) to form a rigidified twin sheet assembly.

Claim 10 (withdrawn): An article made in accordance with claim 7 wherein after the step (j) a rigid member is positioned over the twin sheet assembly prior to the step (o) to form a rigidified triple sheet article.

Claim 11 (allowed): An article resistant to fire and the heat of fire, the article comprising:

a first sheet of co-extruded thermoformable plastic, comprising a surface layer of an intumescent polyolefin composition resistant to fire and a substrate layer of a polyolefin resin, molded over a first mold to provide a first member;

a second sheet as in the first sheet molded over a second mold to provide a second member;

a third member of molded plastic composed of polyolefin resin comprising an array of upward extending ribs, an array of downward extending channels and between the ribs and channels hollow areas providing dead air space;

the third member being compressed between the first and second sheets to provide a rigid unitary structure wherein upper surfaces of the ribs bond to the

substrate layer of the first sheet and lower surfaces of the channels bond to the substrate layer of the second sheet;

the surface layers of the intumescent polyolefin compositions of the first and second sheets being exteriorly visible preventing the substrate layers from supporting a flame upon exposure to fire; and

the surface layers of the intumescent polyolefin compositions of the first and second sheets in combination with the dead air space insulating the third member, the insulated third member resisting the heat of the fire to remain rigid.

Claim 12 (allowed): An article as in claim 11 wherein the third member includes additives imparting high temperature strength.

Claim 13 (allowed): An article as in claim 11 wherein the article is a material handling apparatus.

Claim 14 (allowed): An article as in claim 11 comprising a wireless communications device, the device being adapted to transmit an emergency signal to a

remote monitoring station when said article is exposed to fire or the heat of fire.

Claim 15 (allowed): A material handling apparatus comprising:

an electronic device, the electronic device comprising at least a wireless communicator interfacing with a remote station, thermographic instrumentation developed to monitor external temperature, and circuitry integrating the communicator to the instrumentation;

the thermographic instrumentation responding to variation in external temperature indicative of a fire by actuating circuitry, the circuitry triggering communicator to send an emergency signal to the remote station, the remote station thereby being alerted to heat indicative of fire.

Claim 16 (allowed): A material handling apparatus as in claim 15 wherein the electronic device has at least one supply of power, the at least one supply of power being derived from a solar battery positioned externally upon a surface of said material handling apparatus.

Claim 17 (allowed): A material handling apparatus as in claim 15 wherein the thermographic instrumentation includes a thermoscopic sensor, the sensor being exteriorly positioned to monitor temperature variation.

Claim 18 (allowed): A material handling apparatus as in claim 15 wherein the electronic device is mounted upon a plate for remote attachment to an external surface of the material handling apparatus exposed to fire and the heat of fire.

Claim 19 (rejected): A fire resistant pallet comprising:

a pallet assembly; and

a fire resistant layer formed upon an exterior of said pallet assembly.

Claim 20 (rejected): The fire resistant pallet according to claim 19 wherein said pallet assembly is made of a polyolefin resin and wherein said fire resistant layer is made of an intumescent polyolefin material, said pallet assembly and said fire resistant layer being co-extruded.

Claim 21 (rejected): The fire resistant pallet according to claim 20 wherein said intumescent polyolefin material is disposed only on an exterior of said pallet assembly.

Claim 22 (rejected): The fire resistant pallet according to claim 20 wherein said pallet assembly comprises:

a pallet shell having a first shell half formed from a first member and a second shell half formed from a second member; and

a support structure disposed between and instantly fused to said first shell half and said second shell half to provide support to said pallet shell, said support structure extending across a length of at least one of said first shell.

Claim 23 (rejected): The fire resistant pallet according to claim 19 wherein said fire resistant layer comprises:

an intumescent polyolefin composition resistant to fire, said intumescent polyolefin composition being co-

extruded with at least a portion of said pallet assembly.

Claim 24 (rejected): A fire resistant pallet comprising:

at least a first layer of moldable intumescent material and a second layer of moldable polyolefin material, the first and second layers being co-extruded together prior to being molded into said fire resistant pallet.

Claim 25 (rejected): The fire resistant pallet of claim 24 wherein the moldable intumescent material of the first layer contains a polyolefin material of the second layer.

Claim 26 (rejected): A fire resistant pallet comprising:

a moldable mixture of intumescent materials comprising a polyethylene resin.

Claim 27 (previously presented): The fire resistant pallet of claim 26 wherein the moldable mixture of intumescent materials in a sheet construction has a 4:1 draw ratio to form a deep leg pocket.

APPENDIX 2 - EVIDENCE APPENDIX

1. Declaration of Scott A. W. Muirhead

Submitted October 23, 2007, entered into the record June 3, 2008.

2. Declaration of Ernest A. Coleman

Submitted June 19, 2007, entered into the record July 23, 2007.

OIPE
OCT 26 2007
PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner:	Jose V. Chen
Group Art Unit:	3637
Application No.:	10/798,932
Filed:	March 11, 2004
Applicant:	Scott Arthur William Muirhead
Title:	THERMOFORMED PLATFORM

DECLARATION UNDER 37 C.F.R. 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Scott A.W. Muirhead hereby deposes and says:

1. I reside at 16042 12th Avenue, Surrey, British Columbia, Canada.

2. I have been a practitioner within the thermoforming industry for twenty-five years and have been an owner of one or more thermoforming companies for nineteen years.

3. I am principal of Nextreme, L.L.C., the assignee of the above-identified application.

4. I am also the sole inventor of the above-identified application.

5. U.S. Patent No. 6,006,677 ("the Apps patent") does not include the phrase "a fire resistant layer formed upon an exterior of the pallet assembly." In fact, the Apps Patent does not even include the words "fire", "flame" or any equivalent.

6. The Apps patent does not teach a plastic pallet having a fire resistant layer because the Apps patent states that the plastic pallet is "fabricated from just one type of material." See Col. 2, lines 30-34. The single material is scuffed to form an anti-slip layer from the same base material.

7. The Examiner's statement that "plastics including thermoplastic material provide a fire resistant layer" is inconsistent with the problems encountered by industry and the fire community. It was discovered that fire suppression equipment in warehouses designed to code to extinguish wood pallet fires were incapable of extinguishing polyolefin pallet fires due to their increased intensity when they occur. This led to the promulgation of a new UL classification for plastic pallets of any kind that have the burning characteristics of wood and can be contained by NFPA 213 fire suppression equipment.

8. The brochure entitled "Fire and Polyvinyl Chloride" ("the Vinyl Institute Reference") indicates that polyolefin materials, including polyethylene and polypropylene, exhibit comparably high average peak release rates, when measured according to ASTM E1354 tests, against other materials including wood. It is shown polyethylene for example has a burn rate that is substantially equivalent to twice that of wood.

9. The Examiner's observation that PVC tends to have excellent fire performance properties is irrelevant to the problem of the fire performance properties of polyethylene and polypropylene in the material handling environment.

10. A person of ordinary skill in the art knows that PVC pallets can not be used in low temperature environments because of low impact strength. PVC pallets are rarely widely used for this reason.

11. PVC also releases halogens when burned, which is undesirable.

12. U.S. Patent No. 6,228,914 ("the Ford patent") discloses applying a fire resistant layer to a product after molding. The intumescent composition disclosed in the Ford Patent cannot be co-extruded and molded.

13. The Ford patent states "[t]his material has a relatively low onset intumescent temperature which means that it will commence exfoliation generally after only a few seconds of exposure to an elevated temperature." Therefore, it would be impossible to modify the structure of U.S. Patent No. 5,845,588 ("the Gronnevik patent") by including the material layer taught by Ford because the combination would not survive high temperature extrusion and thermoform molding.

14. In 2000, I conducted a thorough patent search for prior art related to the preparation of co-pending patent application 60/286,450, entitled "High Performance Fuel Tank", which was filed April 27, 2001. During the search I discovered Abu-Isa patent 5,834,535.

15. In January 2001, I began working on a research project to develop an extrudable intumescent material for polyolefin.

16. As part of the research project, I cut several 4" x 4" chips from a sheet of extruded halogen free BA50100 polyethylene supplied by Primex Plastics of Richmond, Indiana.

17. The chips were sent to Delphi Corporation of Sterling Heights, Michigan. There, I collaborated with Mr. Abu-Isa to laminate the intumescent material that is disclosed in U.S. Patent No. 5,834,535, and cited in the instant application onto the chips (to simulate co-extrusion).

18. The laminated chips were sent to Chep USA, Inc. of Orlando, Florida. There, I collaborated with Mr. Torrey to test the samples according to ASTM E1354. The test results are shown in Figure 1 attached hereto.

19. The test results for the samples tested in Figure 1 were unexpected because average peak heat release rate (Peak HRR) was 203 KW/m^3, which is less than one half of the average Peak HRR of wood using an equivalent heat flux. The test results shown in Figure 1 for the samples were superior because a relatively thin layer of comparably expensive intumescent material prevented the underlying structural layer of comparably low cost polyolefin material from igniting during the tests performed. The samples tested comprised a combination of materials in co-extrusion form that could be thermoformed having a 4:1 draw ratio suitable for molding the deep leg pockets of a pallet structure.

20. The patent record shows that Abu-Isa and Torrey subsequent to the collaboration filed U.S. Patent Application Nos. 10/890,351 and 10/045,696 on February 4, 2004 and October 24, 2001, respectively. The instant application is a continuation of application No. 09/803,681 filed March 12, 2001. During the examination of the Torrey application '696 and the Abu-Isa application '351, applicants failed to provide the Office with information contained in publication 2001/0029874 and the instant

application. The information contained in these references are relevant to the patentability of the claims that have been allowed by the Office.

21. In the Office action dated 7/23/2007 the Examiner states: "Further, there is no nexus between the merits of the **claimed** invention and the evidence of the secondary considerations; 2) there is no factual evidence of the stated opinions, such as testing results". Therefore, in this Declaration I have also identified the linkages between the discovery of Abu-Isa patent '535, the origins of the invention contained in Torrey application '696, and the origins of the invention contained in Abu-Isa application '351, Additionally, with Figure 1 I am providing factual evidence in the form of test results.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1000 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the above-identified application or any patent issuing thereon.

Oct 5, 2007
Date

Scott A.W. Muirhead

ASTM E1354 Test Data Summary
CHEP International

08-Mar-01

Material Number	Ignition Time (sec)	Flame Duration (sec)	Initial Weight (grams)	Total Weight Loss (grams)	% Weight Loss	Heat of Comb (mJ/kg)	Avg HRR at 180s KW/m	Peak HRR KW/m	Time of Peak HRR (sec)	Total Heat MJ/m	Total Smoke kg/m
1	66	402	28.5	23	77.8	21.7	149	237	24	49.5	2550
2	72	395	28.5	22.1	74.8	21.2	208	208	26	47	2630
3	74	413	30.3	22.4	74	21.5	163	165	38	48.2	2483
Average	77	404	28.8	22.5	75.5	21.5	203	203	28	48.3	2888

Material tested on 8 March 2001
Material labeled as followed
#1-HDPE with Intumescent Flame Retardant
Note: Materials tested at 32 KW/m exposure, horizontal with spark igniter

Figure 1

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner:	Jose V. Chen
Group Art Unit:	3637
Application No.:	10/798,932
Filed:	March 11, 2004
Applicant:	Scott Arthur William Muirhead
Title:	THERMOFORMED PLATFORM

OIPE IAP22 JUN 25 2007 PATENT & TRADEMARK OFFICE

DECLARATION UNDER 37 C.F.R. 1.132

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Ernest A. Coleman hereby deposes and says:

1. I am a resident of Willow Street, Pennsylvania.

2. I received a Bachelor of Science degree in Chemistry from Rensselaer Polytechnic Institute in 1951.

3. I received a Master of Science degree in Organic Chemistry from the University of Pennsylvania in 1955.

4. I received a Doctorate of Philosophy in Physical Organic Chemistry from the University of Pennsylvania in 1959.

5. Throughout my career as a scientist, I have developed expertise in the fields of polymers and polymer science.

6. I have been employed at various times at: DuPont Plastics in Wilmington, Delaware, and Parkersburg, West Virginia; Library of Congress in Washington, DC; GAF in Wayne, New Jersey; Dart and Kraft (Fiberfil Plastics and Wilson Color) in Paramus,

New Jersey; Union Carbide Silicones in Tarrytown, New York; Norton (now St. Gobain) Plastics and Ceramics in Wayne, New Jersey and Worchester, Massachusetts.

7. I have also been employed as an Adjunct Professor of Organic Chemistry at the University of Connecticut.

8. I have also been a member of the American Association for the Advancement of Science, the American Chemical Society, and the Society of Plastics Engineers ("SPE"). I was elected as a Fellow of the SPE in 1994. I was also a founding member of Polymer Modifiers & Additives Division of the SPE.

9. I am currently employed as a consultant for my own consulting firm, C P Technology.

10. I have no relationship with the assignee of the above-identified patent, Nextreme, L.L.C. ("Nextreme"). However, I am being compensated for the work associated with the preparation of this Declaration. I estimate that my fees will be approximately $ 1,000.00. The fees are not contingent upon the outcome of this matter.

11. I have reviewed the prosecution history for the above-identified patent application.

12. I understand that the examiner has taken the position that all plastics inherently provide fire resistance in the February 20, 2007 Office action. The examiner relied upon two non-patent publications for support for this position. The first publication was an article entitled "The Synthesis and Characterization of New Thermoplastic Fire Resistant Materials" ("the McGrath Reference"). The second publication was a brochure

entitled "Fire and Polyvinyl Chloride" ("the Vinyl Institute Reference").

13. I reviewed the McGrath Reference. The reference discloses two specific engineering resins, high performance poly (arylene sulfide sulfone) homopolymers and aryl phosphine oxide containing comonomers. The reference contains no disclosure or suggestion that all plastics provide fire resistance.

14. Indeed, the McGrath Reference states that the two engineering resins "are considered candidates for fire safe thermoplastic materials." This would suggest to a person of ordinary skill in the art that most, if not all, thermoplastic materials do not provide fire resistance. Since thermoplastic materials are a subclass of plastic materials, this reference would directly contradict the examiner's position.

15. The term "fire safe" is used in the industry to denote a class of polymers that can meet the more demanding application areas of plastics. This includes commercial aircraft where approximately two or three minutes are allowed to evacuate a distressed airplane before the fire hazard from all sources is considered too great to survive. The plastic that is currently used for aircraft interiors is expensive (over $ 20 per pound) and "fire safe" cost effective replacements have been an important target for those doing plastics research for many years. Professor McGrath has been working in this area for many years as have others. So far no "fire safe" candidates have replaced the existing plastic, so the search continues for a truly "fire safe" plastic.

16. The Vinyl Institute Reference does not state that plastics, in general, inherently provide fire resistance. The first two paragraphs of the Vinyl Institute Reference indicate that PVC tends to have excellent fire performance properties, as compared to other plastics. This does not mean that it will not burn. Antimony trioxide is used to further reduce the burning properties of PVC, but it will still burn. As a result, a person of ordinary skill in the art is unlikely to conclude that all plastics inherently provide a fire resistant layer after reviewing the Vinyl Institute Reference.

17. The Vinyl Institute Reference also indicates that unplasticized PVC causes less of a fire hazard than wood under specific test conditions. However, the reference also indicates that the fire properties of plasticized PVC are less favorable than virgin PVC. Since a person of ordinary skill in the art would likely recognize that PVC would have to be plasticized to form the outer layer of a pallet, a person of ordinary skill in the art is unlikely to conclude that a layer of PVC could be used to produce a pallet having a fire resistant layer without modifiers such as antimony trioxide. These modifications to the PVC formula will result in a product that passes specific tests to measure flammability, but other properties will be affected.

18. Also, the Vinyl Institute Reference would be of limited value to a person of ordinary skill in the art because it relies upon ASTM standards. The ASTM standards that relate to the fire testing of plastics typically include the following disclaimer:

> "This standard should be used to measure and describe the fire response of materials, products, or assemblies to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire-hazard or fire risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire-hazard assessment or a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard or fire-risk of a particular end use."

Annual Book of ASTM Standards 2006, Vol. 8.01, D 2843 p. 714 ¶ 1.4. A copy of this standard is attached as an exhibit.

19. I understand that these disclaimers were added to all ASTM fire test methods after materials that passed an industry accepted series of ASTM tests were involved in fires where some lives may have been lost.

20. I have also reviewed U.S. Patent No. 5,845,588 ("the Gronnevik patent"), which was cited by the examiner in the February 20, 2007 Office action.

21. The Gronnevik patent discloses a multi-layer structure, but does not disclose a multi-layer structure in which a fire resistant layer covers a polyolefin base material.

22. The Gronnevik patent indicates that the multi-layer structure provides a structure that has a higher coefficient of friction on the outer layer. See Col. 5, lines 36-40. This prevents objects from slipping on the outer surface of the pallet structure. This problem has no relationship to the inherent lack

of fire resistance in plastic materials. As a result, a person of ordinary skill would be unlikely to combine Gronnevik with either the McGrath Reference or the Vinyl Institute Reference to produce a pallet having a fire resistant layer.

23. The examiner has also indicated that the Gronnevik patent could be combined with U.S. Patent No. 6,228,914 ("the Ford patent") to produce a polyolefin pallet having an intumescent layer that is produced through co-extrusion.

24. The Ford patent discloses an aqueous intumescent composition, which is not suitable for melt processing in a co-extrusion process. As a result, a person of ordinary skill in the art is unlikely to combine the Gronnevik patent with the Ford patent to produce a polyolefin patent having an intumescent layer through a co-extrusion process. The Ford coating is not formulated for compatibility with polymer melts; it is a coating that is formulated to bond to rough surface materials as described in the examples. The coating is applied to an existing surface. This Ford coating is a thermoset polymer that cannot be melt processed once it is heated to the curing temperature. Thus, it is totally unsuitable for extrusion or co-extrusion.

25. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1000 of Title 18 of the United States Code, and that such willful false statements my

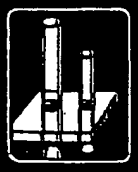
jeopardize the validity of the above-identified application or any patent issuing thereon.

May 24, 2000
Date

Ernest A. Coleman

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Designation: D 2843 – 99 (Reapproved 2004)ε1

Standard Test Method for Density of Smoke from the Burning or Decomposition of Plastics[1]

This standard is issued under the fixed designation D 2843; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

ε1 NOTE—Editorially changed Note 1 in December 2004.

1. Scope*

1.1 This fire-test-response test method covers a laboratory procedure for measuring and observing the relative amounts of smoke obscuration produced by the burning or decomposition of plastics. It is intended to be used for measuring the smoke-producing characteristics of plastics under controlled conditions of combustion or decomposition. Correlation with other fire conditions is not implied. The measurements are made in terms of the loss of light transmission through a collected volume of smoke produced under controlled, standardized conditions. The apparatus is constructed so that the flame and smoke can be observed during the test.[2]

1.2 **Warning**—During the course of combustion, gases or vapors, or both, are evolved that may be hazardous to personnel. Adequate precautions should be taken to protect the operator.

1.3 The values stated in SI units are to be regarded as the standard. The values given in brackets are for information purposes only.

1.4 *This standard should be used to measure and describe the response of materials, products, or assemblies to heat and flame under controlled laboratory conditions and should not be used to describe or appraise the fire-hazard or fire-risk of materials, products, or assemblies under actual fire conditions. However, results of this test may be used as elements of a fire-hazard assessment or a fire risk assessment which takes into account all of the factors which are pertinent to an assessment of the fire hazard or fire-risk of a particular end use.*

1.5 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* Specific warning statements are given in 1.2 and 9.11.

NOTE 1—There is no known ISO equivalent to this standard.

2. Referenced Documents

2.1 *ASTM Standards:*[3]

D 618 Practice for Conditioning Plastics for Testing
D 883 Terminology Relating to Plastics
D 1600 Terminology for Abbreviated Terms Relating to Plastics
E 84 Test Method for Surface Burning Characteristics of Building Materials
E 176 Terminology for Fire Standards
E 662 Test Method for Specific Optical Density of Smoke Generated by Solid Materials
E 691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method
E 906 Test Method for Heat and Visible Smoke Release Rates for Materials and Products
E 1354 Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Colorimeter

3. Terminology

3.1 *Definitions*—The terminology used in this test method is in accordance with Terminologies D 883 and D 1600 (terms relating to plastics) and Terminology E 176 (terms relating to fire).

4. Summary of Test Method

4.1 The test specimen is exposed to flame for the duration of the test, and the smoke is substantially trapped in the chamber in which combustion occurs. A 25 by 25 by 6-mm [1 by 1 by ¼-in.] specimen is placed on supporting metal screen and

[1] This test method is under the jurisdiction of ASTM Committee D20 on Plastics and is the direct responsibility of Subcommittee D20.30 on Thermal Properties (Section D20.30.03).

Current edition approved December 1, 2004. Published January 2005. Originally approved in 1970. Last previous edition approved in 2004 as D 2843 - 99 (2004).

[2] Anonymous, "A Method of Measuring Smoke Density," *NFPA Quarterly*, QNFPA, Vol 57, January 1964, p. 276. Reprint NFPA Q57-9. Available from NFPA, 60 Batterymarch St., Boston, MA 02110.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard.

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burned in a laboratory test chamber (Fig. 1) under active flame conditions using a propane burner operating at a pressure of 276 kPa [40 psi]. The 300 by 300 by 790-mm [12 by 12 by 31-in.] test chamber is instrumented with a light source, photoelectric cell, and meter to measure light absorption horizontally across the 300-mm [12-in.] light beam path. The chamber is closed during the 4-min test period except for the 25-m [1-in.] high ventilation openings around the bottom.

4.2 The light-absorption data are plotted versus time. A typical plot is shown in Fig. 2. Two indexes are used to rate the material: the maximum smoke produced and the smoke-density rating.

5. Significance and Use

5.1 Tests made on a material under conditions herein prescribed can be of considerable value in comparing the relative smoke obscuration characteristics of plastics.

5.2 This test method serves to determine the extent to which plastic materials are likely to smoke under conditions of active burning and decomposition in the presence of flame.

NOTE 2—The visual and instrumental observations from this test compare well with the visual observations of the smoke generated by plastic materials when added to a freely burning large outdoor fire.[4]

5.3 The usefulness of this test procedure is in its ability to measure the amount of smoke obscuration produced in a simple, direct, and meaningful manner under the specified conditions. The degree of obscuration of vision by smoke generated by combustibles can be substantially affected by changes in quantity and form of material, humidity, draft, temperature, and oxygen supply.

6. Apparatus

6.1 The smoke chamber shall be constructed essentially as shown in Fig. 1.[5]

6.1.1 *Chamber:*

6.1.1.1 The chamber shall consist of a 14-gage (B & S) 300 by 300 by 790-mm [12 by 12 by 31-in.] aluminum box to which is hinged a heat-resistant glass glazed door. This box shall be mounted on a 350 by 400 by 57-mm [14 by 16 by 2¼-in.] base which houses the controls. Dependent upon the materials tested, the metal may require protection from corrosion.

6.1.1.2 The chamber shall be sealed except for 25 by 230-mm [1 by 9-in.] openings on the four sides of the bottom of the chamber. A 1700-L/min [60-ft³/min] blower shall be mounted on one side of the chamber. The inlet duct to the blower shall be equipped with a close-fitting damper. The outlet of the blower shall be connected through a duct to the laboratory exhaust system. If the chamber is in a ventilated hood, no connection to the lab exhaust system through a duct is needed.

6.1.1.3 The two sides adjacent to the door shall be fitted with 70-mm [2¾ in.] diameter smoke-tight glazed areas centered 480 mm [19¾ in.] above the base. At these locations and outside the chamber, boxes containing the optical equipment and additional controls shall be attached.

6.1.1.4 A removable white plastic plate shall be attached to the back of the chamber. There shall be a 90 by 150-mm [3½ by 6-in.] clear area centered about 480 mm above the bottom of the chamber through which is seen an illuminated white-on-red exit sign. The white background permits observation of the flame, smoke, and burning characteristics of the material. The viewing of the exit sign helps to correlate visibility and measured values.

6.1.2 *Specimen Holder:*

6.1.2.1 The specimen shall be supported on a 64-mm [2½-in.] square of 6 by 6-mm, 0.9-mm gage [¼ by ¼-in., 0.035-in. gage] stainless steel wire cloth 220 mm [8¾ in.] above the base and equidistant from all sides of the chamber. This screen shall lie in a stainless steel bezel supported by a rod through the right side of the chamber. From the same rod, a similar bezel shall be located 76 mm [3 in.] below, and it shall support a square of fire resistant material which catches any particles that may drip from the specimen during the test. By rotating the specimen holder rod, the burning specimen can be quenched in a shallow pan of water positioned below the specimen holder.

6.1.3 *Ignition System:*

6.1.3.1 The specimen shall be ignited by a propane flame from a burner operating at a pressure of 276 kPa [40 psi]. The fuel (Note 3) shall be mixed with air which has been propelled through the burner by the venturi effect of the propane as it passes from a 0.13-mm [0.0005-in.] diameter orifice (Note 4), and the burner shall be assembled as shown in the exploded view of the burner in Fig. 3. The burner must be designed to provide adequate outside air.

NOTE 3—Commercial grade 85.0 % minimum, gross heating value 23 000 cal/litre [2590 Btu/ft³] propane meets the requirements.

NOTE 4—Since the orifice provides the metering effect proportionate to the supply pressure, care must be taken that the orifice is the only means of fuel egress.

6.1.3.2 The burner shall be capable of being positioned quickly under the specimen so that the axis of the burner falls on a line passing through a point 8 mm [5/16 in.] above the base at one back corner of the chamber extending diagonally across the chamber and sloping upward at 45 deg with the base. The exit opening of the burner shall be 260 mm [10¼ in.] from the reference point at the rear of the chamber.

6.1.3.3 A duct at least 150 mm [6 in.] outside of the chamber shall provide the air piped to the burner.

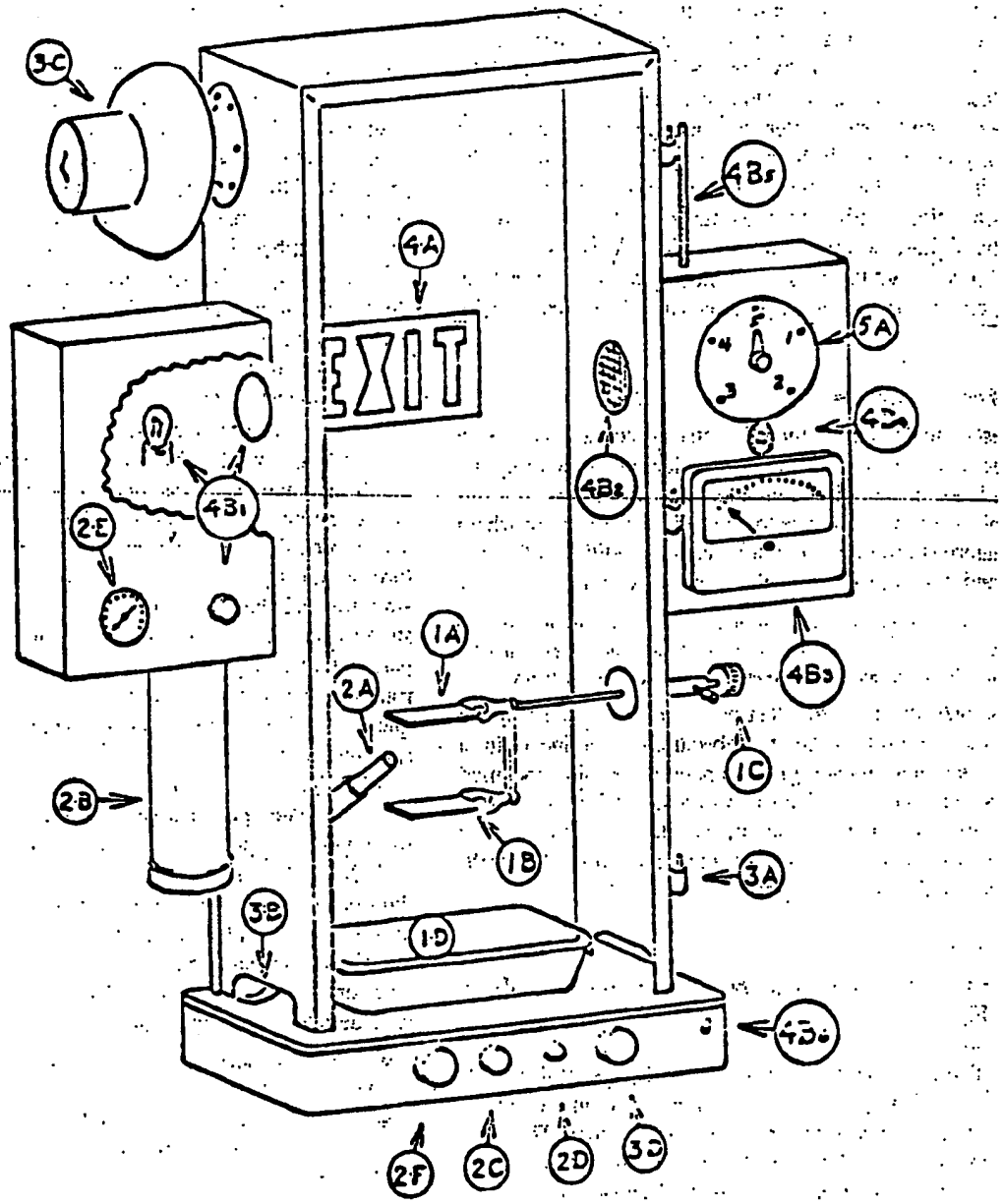
6.1.3.4 Propane pressure shall be adjustable and preferably automatically regulated. Propane pressure shall be indicated by means of a Bourdon tube gage.

6.1.4 *Photometric System:*

6.1.4.1 A light source, a barrier-layer photoelectric cell, and a temperature compensated meter shall be used to measure the proportion of a light beam which penetrates a 300-mm [12-in.] path through the smoke. The light path shall be arranged horizontally as shown in Fig. 4.

[4] Bartosic, A. J., and Rarig, F. J., "Evaluation of the XP2 Smoke Density Chamber," *Symposium on Fire Test Methods—Restraint & Smoke, ASTM STP 422*, ASTM, Philadelphia, PA, 1966.

[5] Detailed drawings of the smoke chamber are also available at a nominal cost from ASTM Headquarters. Order Adjunct: ADJD2843.



1. Specimen Holder
 - *A* Stainless steel screen
 - *B* Fire-Resistant Sheet
 - *C* Adjusting knob
 - *D* Quench pan
2. Ignition
 - *A* Burner
 - *B* Propane tank
 - *C* Gas shut-off valve
 - *D* Pressure regulator adjustment
 - *E* Pressure indicator
 - *F* Burner-positioning knob
3. Cabinet (shown without door)
 - *A* Hinges (door gasketed three sides)
 - *B* Vents (25-mm [1-in.] high opening four sides)
 - *C* Blower (damper on mounting side)
 - *D* Control (blower on when damper is open)
4. Photometer
 - *A* Visual system (exit sign)
 - *B* Measuring system
 - *1* Light source and adjusting transformer
 - *2* Photronic cell and grid (to block stray light)
 - *3* Meter (indicating percent of light absorbed)
 - *4* Temperature compensation
 - *5* Photocell temperature monitor
 - *6* Range change
5. Timer
 - *A* Indicator, 0 to 5 min (friction reset)

FIG. 1 Schematic Diagram of Smoke Chamber

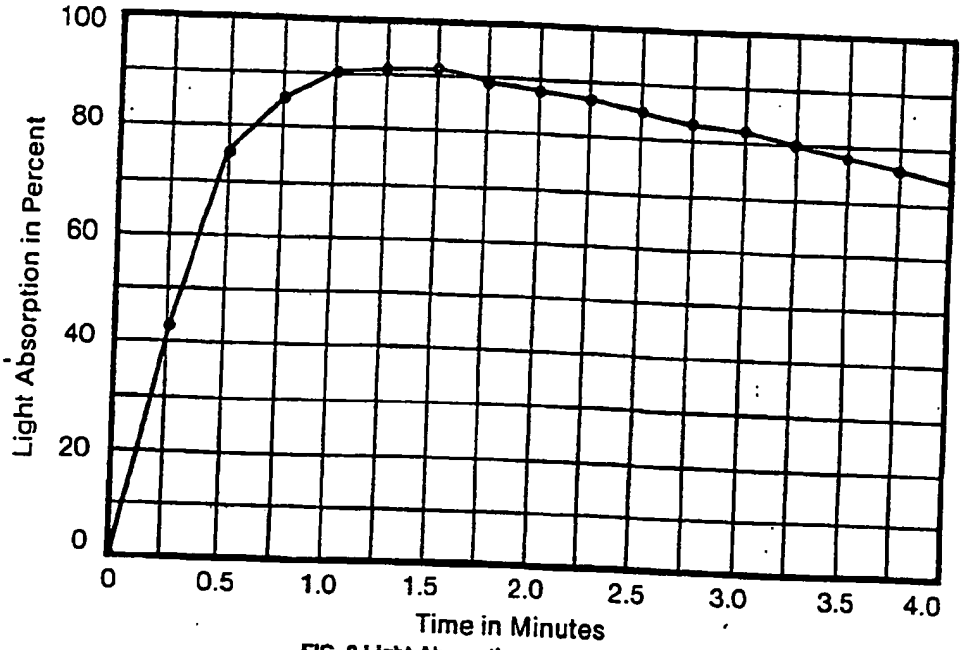


FIG. 2 Light Absorption versus Time

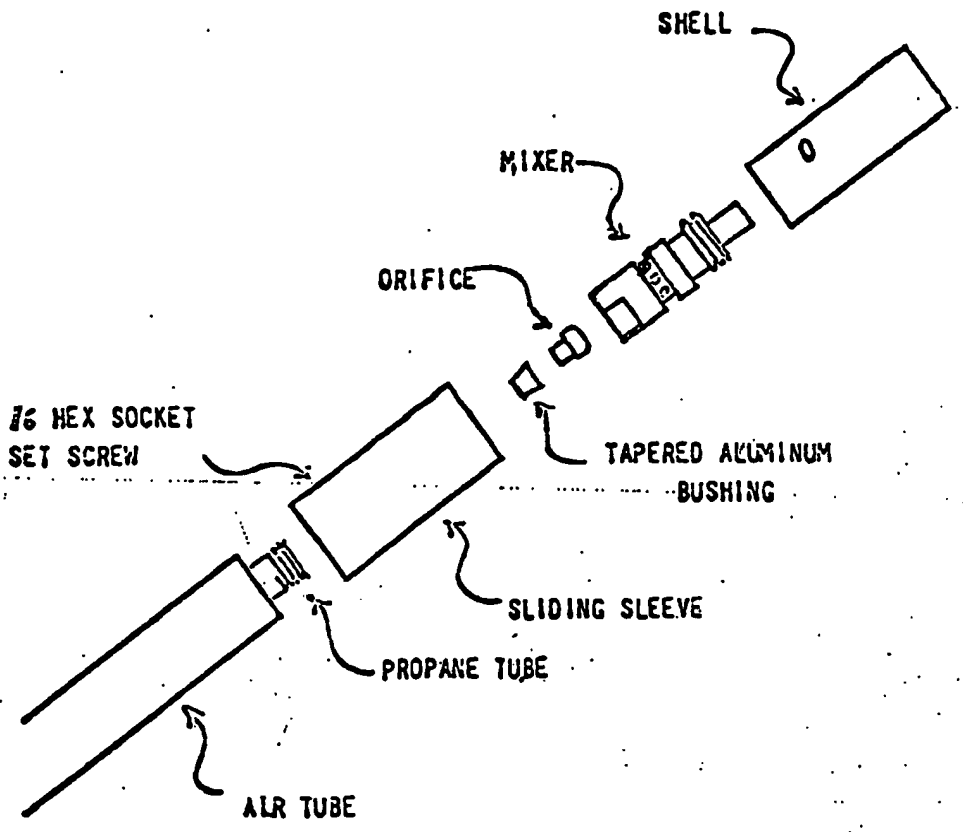
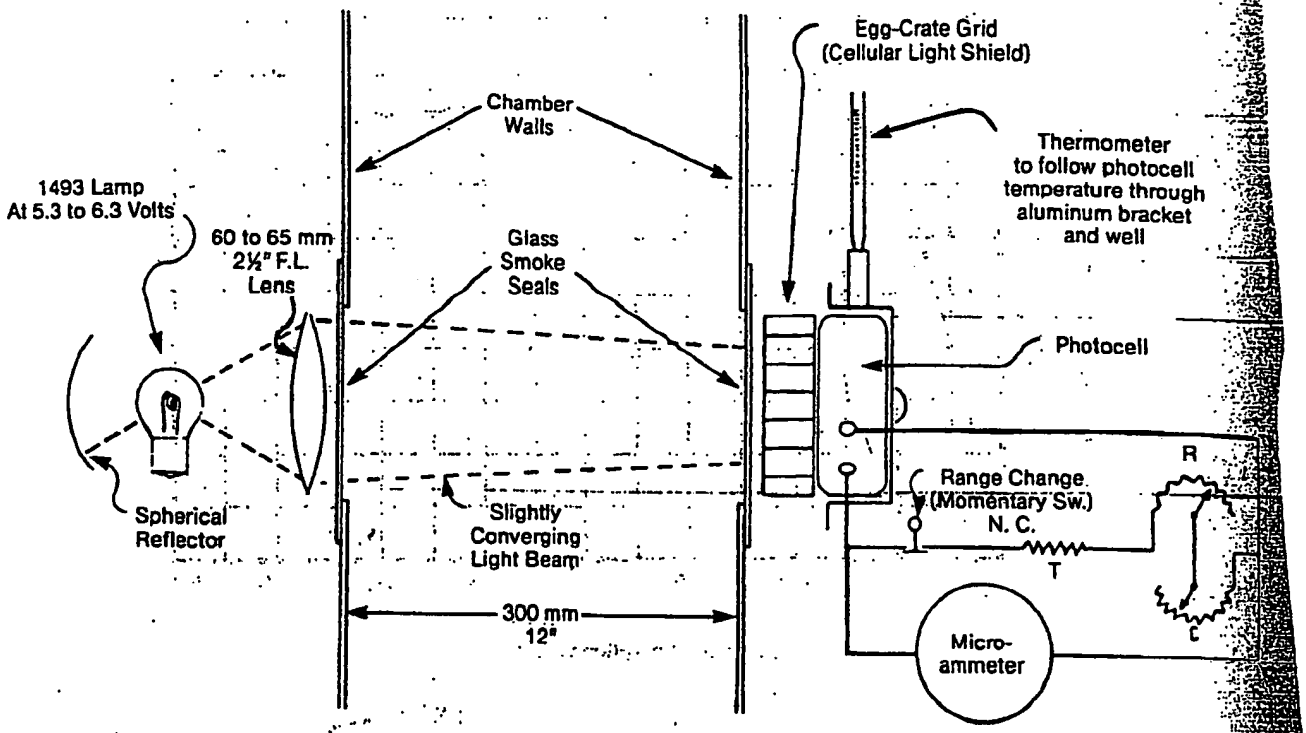


FIG. 3 Exploded View of Burner

6.1.4.2 The light source shall be mounted in a box (4B1 in Fig. 1) extending from the left side of the chamber at the mean height of 480 mm [19¾ in.] above the base. The light source shall be a compact filament microscope lamp No. 1493 operated at 5.8 V and a spherical reflector, with power supplied by a voltage-regulating transformer. A 60 to 65-mm [2½-in.] focal length lens shall focus a spot of light on the photocell in the right instrument panel.

6.1.4.3 Another box containing the photometer (*4 B2* in Fig. 1) shall be attached to the right side of the chamber. The barrier-layer photoelectric cell shall have standard observer spectral response. An egg-crate grid in front of the photocell

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T = Temperature-sensitive winding in or on meter case to increase in resistance in proportion to increase in meter resistance with temperature.
R = Potentiometer with calibrated scale to reduce resistance in proportion to decrease in photocell output with rise in temperature.
C = Potentiometer to calibrate total resistance of shunt to change meter sensitivity exactly by 10:1 ratio.

FIG. 4 Smoke Density Test Chamber Photometer

shall be used to protect the cell from stray light. The grid shall be finished in dull black and have openings at least twice as deep as they are wide. The current produced by the photocell is indicated in terms of percent light absorption on a meter. The photocell linearity decreases as the temperature increases; compensations shall therefore be made.

NOTE 5—Photocell manufacturers recommend operating the photocell at temperatures not exceeding 50°C.

6.1.4.4 The meter shall have two ranges. The range change shall be accomplished by shunting the meter to one tenth of its sensitivity. When smoke accumulates to absorb 90 percent of the light beam, a momentary switch shall be depressed returning the meter to its basic sensitivity. By doing this the meter scale will then read from 90 to 100 % instead of 0 to 100 %.

6.1.5 *Timing Device*—A clock to indicate 15-s intervals shall be used. If the time intervals are audibly marked it will be convenient for the operator to record his observations. A clutch shall be used to reset the clock at the start of a test. The block shall be coupled to the burner-positioning device and it shall start when the burner is swung into test position.

6.1.6 *Planimeter*—A planimeter or other suitable means shall be used for measuring the area under the light-absorption curve.

7. Test Specimen

7.1 The standard specimen shall be 25.4 ± 0.3 by 25.4 ± 0.3 by 6.2 ± 0.3 mm [1 ± 0.01 by 1 ± 0.01 by ¼ ± 0.01 in.]. Thicknesses other than 6.2 mm [¼ in.] may be used and their size must be reported with the smoke density values (Note 6). Material thinner than 6.2 mm [¼ in.] may be tested, either in its normal use thickness, or by stacking and forming a composite specimen approximately 6.2 mm [¼ in.] thick. Material thicker than 6.2 mm [¼ in.] may be tested either in its normal use thickness or by machining the material down to a thickness of 6.2 mm [¼ in.].

NOTE 6—If specimens other than the standard specimen are to be used, cooperating laboratories should agree upon preparation procedures and dimensions of the specimen. The results in such cases may vary from the results obtained with the standard specimen.

7.2 The specimens shall be sanded, machined, or die cut in a manner that produces a cut surface that is free from projecting fibers, chips, and ridges.

7.3 The test sample shall consist of three specimens.

8. Conditioning

8.1 *Conditioning*—Condition the test specimens at 23 ± 2°C [73.4 ± 3.6°F] and 50 ± 5 % relative humidity for not less than 40 h prior to test in accordance with Procedure A of Practice D 618, for those tests where conditioning is required. In cases of disagreement, the tolerances shall be ±1°C [±1.8°F] and ±2 % relative humidity.

8.2 *Test Conditions*—Conduct tests in the standard laboratory atmosphere of 23 ± 2°C [73.4 ± 3.6°F] and 50 ± 5 % relative humidity, unless otherwise specified in the test methods or in this test method. In cases of disagreement, the tolerances shall be 1°C [±1.8°F] and ±2 % relative humidity.

8.3 Tests shall be conducted in a hood that has a window for observing the test.

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Standard Procedure

9.1 Turn on the photometer lamp, exit sign, and exhaust ›wer.

9.2 Turn on the propane, ignite the burner, and adjust the ›pane pressure to 276 kPa [40 psi]. Warning—Do not fail to ›ht the burner immediately.

9.3 Set the temperature compensation.

9.4 Adjust the lamp control to zero percent light absorption.

9.5 Lay the test specimen flat on the screen in such a ›sition that the burner flame will be directly under the ›cimen when the burner is swung into position.

9.6 Set the timer to zero.

9.7 Shut off the exhaust blower, close the smoke chamber ›r, and immediately position the burner under the specimen ›d start the timer.

9.8 If in a hood, shut off the hood fan and close the hood ›r to within 50 mm [2 in.] of the bottom of the hood.

9.9 Record the percent light absorbed at 15-s intervals for 4 ›n.

9.10 Record observations during the conduct of the test. ›lude the time it takes for the sample to burst into flame, the ›e for flame extinguishment or specimen consumption, the ›curation of the exit sign by smoke accumulation, and any ›eral or unusual burning characteristics noted such as ›ting, dripping, foaming, or charring.

9.11 Upon completion of the test, turn on the exhaust ›wer to ventilate the combustion products from the chamber. ›rning—It should be noted that for some materials the ›ducts of burning may be toxic, and care should be taken to ›rd the operator from the effects of these gases. The ›tilating fan in the hood should be turned on and the damper ›ed immediately after the test is completed before opening ›hood door in order to remove any irritating products of the ›. The exhaust fan is turned off and the hood damper closed ›ng the test to prevent back draft.)

9.12 Open the door and clean the combustion deposits from ›photometer, exit sign, and door glass with detergent and ›er. Burn off any material remaining on the screen or replace ›screen and asbestos square for the next test.

9.13 Run all tests in triplicate.

9.14 At the beginning of each series or at least once a day, ›ck the light absorption of the meter against a calibrated ›ral filter of approximately 50 % absorption. Check the ›% absorption point against an opaque plate.

Special Procedure

10.1 For materials which drip excessively, a second or ›liary burner (with separate propane gas supply) shall be ›duced into the chamber. See Fig. 5 and auxiliary burner ›s list.

10.2 The asbestos sheet (Item 1B of Fig. 1) shall be replaced ›a stainless steel collector tray. This tray has a slight taper ›mit the drippings to collect at the bottom. See item 11 of ›5 and parts list for auxiliary burner.

10.3 The auxiliary burner shall be ignited at the same time ›standard burner is ignited. The auxiliary burner shall be operated at 138 kPa [20 psi] and it shall be positioned in such a manner that its flame is directed at the center of the collector tray.

NOTE 7—It may be helpful to place a lightweight, about 1100 g [2.5 lbs], on the aluminum mounting plate (Item 12, Fig. 5) to prevent movement of the burner during the test.

10.4 In all other respects the procedures of Section 8 shall be followed.

11. Optional Procedures

11.1 The output of the photocell may be recorded versus time on an appropriate graphic recorder.

11.2 With a suitably sensitive meter, more than one decade change may be used to separate readings in the very dense smoke range.

12. Treatment of Data

12.1 Average the readings at 15-s intervals of light absorption for the three specimens in each group. Plot the average light absorption against time on linear paper. Fig. 2 is a sample curve.

12.2 Read the maximum smoke density as the highest point on the curve.

12.3 Determine the total smoke produced by measuring the area under the curve. The smoke density rating represents the total amount of smoke present in the chamber for the 4-min time interval. Measure the total smoke produced by the area under the curve of light absorption versus time, divided by the total area of the graph, 0-4 min 0-100 % light absorption, times 100.

NOTE 8—*Example*—In the light absorption-time plot in Fig. 2, the plot has been made using 10 mm [0.39 in.] equal to 10 % as the ordinate and 10 mm [0.39 in.] equal to 0.25 min as the absicca. The graph area for 4 min is found to be 16 000 mm^2 [24.80 $in.^2$]. The area under the curve is found to be 12 610 mm^2 [19.55 $in.^2$]. The smoke density rating, %, is then computed as follows:

$$\text{Smoke density rating} = (12610/16000 \times 100 = 78.8 \text{ (dimensions in millimetres)}$$
$$= (19.55/24.80) \times 100 = 78.8 \text{ (dimensions in inches)}$$

13. Report

13.1 Report the following information:

13.1.1 Identification of the material,

13.1.2 Dimensions of the specimen,

13.1.3 Readings of light absorption at 15-s intervals for each test and average,

13.1.4 Plots of average light absorption versus time,

13.1.5 Maximum smoke density in percent light absorption,

13.1.6 Area in percent under the light absorption-time curve (smoke density rating),

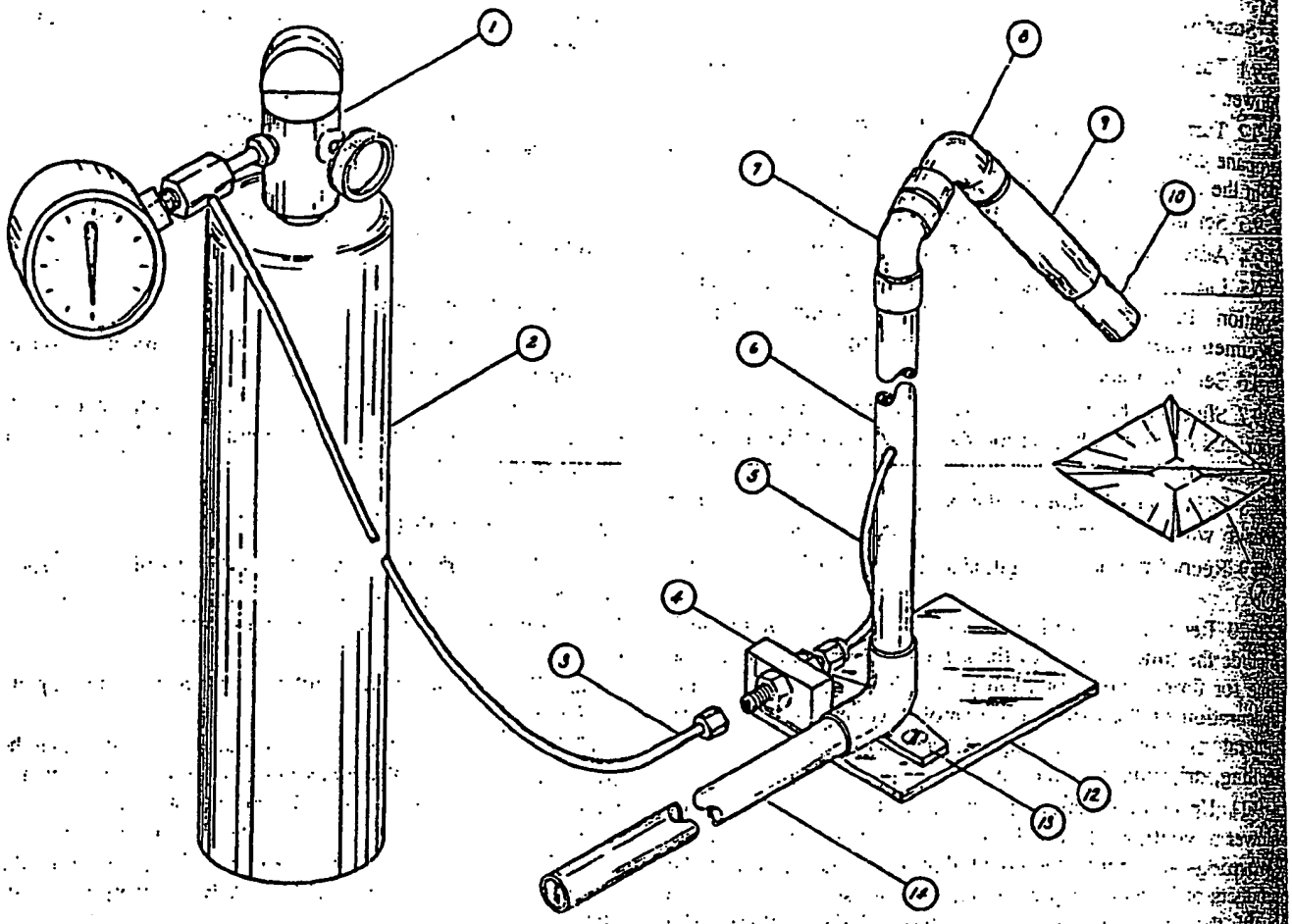
13.1.7 Observations on behavior of material,

13.1.8 Observations on obscurement of exit sign,

13.1.9 The details of any departure from the specifications of the method for testing, and

13.1.10 The caveat contained in 1.4 herein shall be incorporated in its entirety in the report issued.

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Auxiliary Burner Parts List

1. Low pressure propane gas regulator (0 to 60 psi gage).
2. Propane fuel tank.
3. Flexible gas line.
4. Aluminum support bracket.
5. ⅛ in. O.D. copper tube (flexible).
6. ½ in. diameter copper tube 8 in. long.
7. 45° extruded and expanded copper fitting.
8. 90° extruded and expanded copper fitting. (4 in. from bend to end of burner head)
9. Sliding sleeve.
10. Burner head. (Same as standard burner head)
11. S.S. collector tray (2½ by 2½ by ⅜ in. deep with ½ in. sq. bottom).
12. Aluminum mounting plate. (3 by 3½ in.)
13. 90° elbow and wall flange. (copper)
14. ½ in. diameter copper tube 8¾ in. long.

FIG. 5 Auxiliary Burner

14. Precision and Bias (Standard Procedure)[6]

14.1 Table 1 is based on a round robin completed in 1998 in accordance with Practice E 691, involving five materials tested by six laboratories. For each material, all the samples were prepared at one source, but the individual specimens were prepared at the laboratories that tested them. Each test result was the average of three individual determinations.

14.1.1 It is important to note that the SRD rating can only be a whole number between the range of 0 and 100. Thus, values that are close to 100 such as material B and those close to 0 such as materials D and E may not have a normal distribution as is assumed in Practice E 691. The distribution would be skewed. If the standard deviation is applied to these numbers, the value range could exceed 100 or be less than 0. Practice E 691 does not allow for calculating values outside the normal distribution. Thus, caution should be used in applying these statistics to numbers near the minimum and maximum of the test method.

[6] Supporting data are available from ASTM Headquarters. Request RR:D20–1203.

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TABLE 1 Smoke Density Rating (SDR)

Material	Average, %	S_r[A]	S_R[B]	I[C]	R[D]
Polystyrene	90.0	1.94	4.16	5.44	11.64
General purpose polycarbonate	54.7	7.65	15.77	21.41	44.16
Abrasion resistant polycarbonate	44.5	7.00	22.55	19.61	63.13
Impact acrylic	6.1	2.25	6.78	6.29	18.98
PMMA copolymer	3.8	1.46	4.28	4.08	11.98

[A] S_r = within-laboratory standard deviation for the indicated material. It is obtained by pooling the laboratory standard deviations of the test results from all of the participating laboratories:

$$S_r = [(S_1)^2 + (S_2)^2 \ldots + (S_n)^2]/n]^{1/2}$$

[B] S_R = between-laboratories reproducibility, expressed as standard deviation:

$$S_R = [S_r^2 + S_L^2]^{1/2}$$

[C] I = within-laboratory critical interval between two test results = 2.8 × S_r.

[D] R = between-laboratories critical interval between two test results = 2.8 × S_R.

14.2 **Warning**—The following explanations of I_r and I_R (14.3.1-14.3.3) are only intended to present a meaningful way of considering the *approximate* precision of this test method. The data in Table 1 should not be rigorously applied to acceptance or rejection of material, as those data are specific to the round robin and may not be representative of other lots, conditions, materials, or laboratories.

14.2.1 Users of this test method should apply the principles outlined in Practice E 691 to generate data specific to their laboratory and materials, or between specific laboratories. The principles of 14.3-14.3.3 would then be valid for such data.

14.3 *Concept of I_r and I_R*—If S_r and S_R have been calculated from a large enough body of data, and for test results that were averages from testing three specimens:

14.3.1 *I_r: Repeatability*—Comparing two test results for the same material, obtained by the same operator using the same equipment on the same day, the two test results should be judged not equivalent if they differ by more than the I_r value for that material.

14.3.2 *I_R: Reproducibility*—Comparing two test results for the same material, obtained by different operators using different equipment on different days, the two test results should be judged not equivalent if they differ by more than the I_R value for that material.

14.3.3 Any judgment per 14.3.1 and 14.3.2 would have an approximate 95 % (0.95) probability of being correct.

14.4 *Bias*—Bias is a systematic error which contributes to the difference between a test result and a true (or reference) value. There are no recognized standards by which to estimate bias of this test method.

15. Precision and Bias (Special Procedure)[7]

15.1 Table 2 is based on a round robin conducted in 1982 per Practice E 691, involving nine materials tested by six laboratories. For each material, all the samples were prepared at one source, but the individual specimens were prepared at the laboratories which tested them. Each test result was the average of three individual determinations. Each lab obtained five test results for each material.

15.2 **Warning**—The following explanations of I_r and I_R (15.3.1-15.3.3) are only intended to present a meaningful way of considering the *approximate* precision of this test method. The data in Table 2 should not be rigorously applied to acceptance or rejection of material, as those data are specific to the round robin and may not be representative of other lots, conditions, materials, or laboratories.

15.2.1 Users of this test method should apply the principles outlined in Practice E 691 to generate data specific to their laboratory and materials, or between specific laboratories. The principles of 15.3-15.3.3 would then be valid for such data.

15.3 *Concept of I_r and I_R*—If S_r and S_R have been calculated from a large enough body of data, and for test results that were averages from testing three specimens:

15.3.1 *I_r: Repeatability*—Comparing two test results for the same material, obtained by the same operator using the same equipment on the same day, the two test results should be judged not equivalent if they differ by more than the I_r value for that material.

15.3.2 *I_R: Reproducibility*—Comparing two test results for the same material, obtained by different operators using different equipment on different days, the two test results should be judged not equivalent if they differ by more than the I_R value for that material.

15.3.3 Any judgment per 15.3.1 and 15.3.2 would have an approximate 95 % (0.95) probability of being correct.

15.4 *Bias*—Bias is a systematic error which contributes to the difference between a test result and a true (or reference) value. There are no recognized standards by which to estimate bias of this test method.

16. Keywords

16.1 burning; decomposition; plastics; smoke; smoke density; smoke development

[7] Supporting data are available from ASTM Headquarters. Request RR:D20-77.

TABLE 2 Precision Data for Special Procedure

Values in Units of Smoke Density Rating, Absolute %					
Material	Average	S_r[A]	S_R[B]	I_r[C]	I_R[C]
Molded polystyrene	88.00	2.90	3.72	8.22	10.55
Polystyrene sheet	81.90	3.61	5.26	10.21	14.89
PMMA	3.64	1.50	2.21	4.25	6.25
Polycarbonate	68.73	3.55	9.26	10.03	26.20
LDPE	63.53	4.30	9.24	12.17	26.15
HDPE	46.23	4.09	15.66	11.57	44.33
Modified HDPE	50.38	2.83	16.75	8.02	47.41
Molded acrylic	3.64	1.09	1.35	3.07	3.81
Impact modified acrylic	7.87	1.55	3.28	4.38	9.28

[A] S_r = within-laboratory standard deviation of the average.
[B] S_R = between-laboratories standard deviation of the average.
[C] $I_r = 2.83\ S_r$; $I_R = 2.83\ S_R$.

APPENDIX

(Nonmandatory Information)

X1. ADDITIONAL INFORMATION

X1.1 Test Method D 2843 is used by model code organizations in controlling the use of plastic materials in light transmitting applications. It is allowed as an alternate to the Test Method E 84 smoke measurement since Test Method D 2843 can readily be performed on thermoplastic materials that may drip and fall out of the Test Method E 84 apparatus. Thermoplastic materials comprise most of the plastics used in light transmitting applications. Many tests are available to measure smoke from burning materials (for example, Test Methods E 662, E 906, E 1354, and others). None of these tests, including Test Method D 2843, have shown any extensive correlation with each other.

SUMMARY OF CHANGES

Committee D20 has identified the location of selected changes to this standard since the last issue, D 2843 - 99 (2004), that may impact the use of this standard. (December 1, 2004)

(*1*) Editorial changed the ISO Equivalency Statement in Note 1.

Committee D20 has identified the location of selected changes to this standard since the last issue, D 2843 - 99, that may impact the use of this standard. (March 1, 2004)

(*1*) Reapproved without change.

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APPENDIX 3 - RELATED PROCEEDING APPENDIX

There are no known related proceedings.